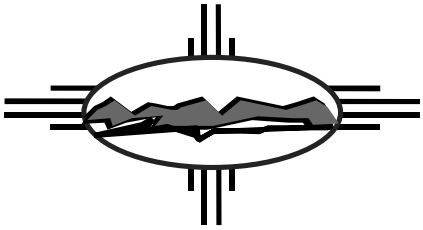
STANDARD OPERATING PROCEDURE

Title: **Well Development**	Identifier: **ER-SOP-5.02**	Revision: **1**	Effective Date: **06/01/99**



ER PROJECT

APPROVALS FOR USE

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LOS ALAMOS NATIONAL LABORATORY

Well Development

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NOTE: Environmental Restoration (ER) Project personnel may produce paper copies of this procedure printed from the controlled document electronic file. However, it is their responsibility to ensure that they are trained on and utilizing the current version of this procedure. The procedure author may be contacted if text is unclear.

1.0 PURPOSE

This Standard Operating Procedure (SOP) states the responsibilities and describes the process for removing introduced foreign materials from the groundwater, well annulus, or well screen during monitoring well installation, and for facilitating hydraulic communication between the screened formation and the monitoring well at the Los Alamos National Laboratory (Laboratory) ER Project.

2.0 TRAINING

2.1 All users of this SOP are trained by self-study, and the training is documented in accordance with QP-2.2.

2.2 The **Field Team Leader** (FTL) will monitor the proper implementation of this procedure and ensure that relevant team members have completed all applicable training assignments in accordance with QP-2.2.

3.0 DEFINITIONS

3.1 *Overpumping* —Involves pumping the well down as low as possible and allowing it to refill.

3.2 *Hydrogen-ion activity (pH)* — The effective concentration (activity) of dissociated hydrogen ions [H+]. A measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions, increasing with alkalinity and decreasing as acidity increases.

3.3 *Nephelometric turbidity meter* — An instrument used for determining the concentration of particle size of suspensions by means of transmitted or reflected light.

3.4 *Site-Specific Health and Safety Plan (SSHASP)*—A health and safety plan that is specific to a site or ER-related field activity that has been approved by an ER health and safety representative. This document contains information specific to the project including scope of work, relevant history, descriptions of hazards by activity associated with the project site(s), and techniques for

exposure mitigation (e.g., personal protective equipment [PPE]) and hazard mitigation.

3.5 *Specific (electrical) conductance* — A measure of the ease with which a conduction current flows through a substance under the influence of an applied electric field. It is dependant upon the presence of ions (total and relative concentrations, valence, and mobility) and temperature. It is the reciprocal of resistivity and is measured in either siemens (S) or micro-ohms per centimeter (μohm/cm) at 25°C.

3.6 *Surging* — A well-development technique where the surge block is alternately lifted and dropped within the borehole above or adjacent to the screen to create a strong inward and outward movement of water through the well intake.

3.7 *Turbidity (nephelometric)* — A measure of the intensity of light scattered by sample particulates relative to a standard reference suspension. The range of water turbidity is measured from 0 to 40 nephelometric turbidity units (NTU).

4.0 BACKGROUND AND PRECAUTIONS

Note: This SOP is to be used in conjunction with an approved SSHASP. Also, consult the SSHASP for information on and use of all PPE.

4.1 All monitoring well installation procedures create a skin, or filter cake, on the borehole wall. During monitoring well development, the fine particulate matter is removed from the well or aquifer formation near the screen by removing the filter cake. There are two primary methods for developing monitoring wells: overpumping and surging (water). These methods are used to break the fines (fine particulate matter) away from the borehole or well walls. After the fines are broken away, they are removed by either pumping or bailing. Refer to the site-specific work plan for more information on the scope of work activities for determining the method to use.

4.2 There are three primary factors that influence the development of a monitoring well:

- the type of geologic material,
- the design and completion of the well and
- the type of drilling technology employed in the well construction.

Because of the small size of weathering products from the volcanic tuff, in some of the alluvial canyon aquifers in the region, it is virtually impossible to eliminate turbidity while developing the well.

4.3 The following sections discuss the different methods for well development and gives information to help choose a method.

4.3.1 Overpumping involves pumping the well down as low as possible and allowing it to refill. The increased velocities, created by refilling, remove fines. This method is usually not very effective because the water flow is in one direction and at relatively low velocities.

4.3.2 Surging involves raising and lowering a surge or swab block inside the well. The resulting motion of the water creates a washing effect and removes the borehole skin and fines from the formation. The fines must occasionally be pumped or bailed from the well to prevent sand locking of the surge block. The rubber or viton seals on the surge block are the same diameter as the inside of the well or ½ in. smaller if surging is conducted inside the screened interval. A 3-ft-long stroke is typical.

4.3.3 Surging with a vented (pressure-relief) block (see Attachment B) and rawhiding is the preferred method for well development, although no one method is appropriate for all situations.

4.3.4 Regulatory guidance may be found in the RCRA Ground Water Monitoring Technical Enforcement Guidance Document (EPA, 1986), and the EPA Handbook (EPA, 1991).

5.0 EQUIPMENT

A checklist of suggested equipment and supplies employed to implement this procedure is provided in Attachment A. You will also need the equipment listed in Attachment A of ER-SOP 4.01 and Attachment B of ER-SOP 5.01.

6.0 PROCEDURE

Note: Deviations from SOPs are made in accordance with QP-4.2.

6.1 Obtain permission to discharge development water or coordinate efforts to purchase appropriate containment vessels for development. Assemble containers for the temporary storage of the water produced during well development. The containers must be structurally sound, compatible with anticipated contaminants, and field manageable.

6.2 Decontaminate all equipment before developing each well according to ER-SOP-1.08.

6.3 Perform the development as soon as practical after well installation, but no sooner than 48 hrs after grouting is completed. Do not use any dispersing agents, acids, or disinfectants to enhance the development of the well. Do not add water to aid development except under the following special conditions. If problems or unusual conditions are encountered, notify the site geologist as soon as possible.

Note: In the installation of some monitoring wells in perched alluvial aquifers at Los Alamos, partial development is desirable before emplacing the bentonite seal and cement grout because of settling that commonly occurs.

6.3.1 Assemble the necessary equipment on a plastic sheet outside of the splash range.

6.3.2 Record pertinent information and on the Well Development section of the Borehole/Well Construction Field Data Log. A copy of this form and instructions for completing the form are provided in Attachment B of ER-SOP-5.01.

6.3.3 Open the monitoring well and take the air-monitoring reading at the top of the casing and in the breathing zone.

6.3.4 Measure and record depth-to-water and the total depth of the monitoring well according to ER-SOP-7.02.

6.3.5 Develop the well until the well is free of sediment (to be determined by FTL) and the appropriate volumes of water have been removed (refer to Section 6.3.5.4. below). If this is not possible, consult project documents for guidance. The Hazardous and Solid Waste Amendments Permit (May, 1990) requires attempting to develop until the turbidity is <5 NTU. Be sure to record all changes in the Daily Activity Log (Attachment A in ER-SOP-1.04). If the well is not free of sediment after the appropriate volumes of water have been removed, continue until twice the appropriate volume of water has been removed.

6.3.5.1 Note the initial color, clarity, and any obvious odor of the water.

6.3.5.2 Measure and record the initial pH, temperature, and specific conductance of the water.

6.3.5.3 Containerize all water produced by development in contaminated areas or areas suspected of contamination unless otherwise specified in project documents. It may be acceptable to discharge development water in the area surrounding the well; however, if water is containerized, clearly label each container with the location ID, date, and time. Labels should be placed on the lid of the container and covered with clear tape to ensure their permanence. Base the determination of an appropriate disposal method on the first round of analytical results from each well.

6.3.5.4 For those wells where the boring was made without the use of drilling fluid (mud or water), remove five times the standing water volume in the well (well screen and casing plus saturated annulus). Should recharge be so slow that five volumes could not be removed in 1 day or the water is not sediment free after this five-volume removal, the site geologist will select an alternate procedure for verifying that the well is properly developed.

6.3.5.5 Complete the appropriate data entry requirements on the Borehole/Well Completion Information form to document well development. A copy of the form and instructions for completing it are given in Attachment A of ER-SOP-5.01.

6.3.6 Groundwater samples may be collected from the monitoring well 30 days after well development is complete, unless otherwise specified in project documents. When samples are collected, ship them to the analytical lab as per ER-SOP-1.03.

6.3.7 Make sure all monitoring well locations are properly staked and the location ID is readily visible on the protective casing.

6.3.8 Contact the analytical laboratory to ensure that samples arrived safely and that the instructions for sample analyses are clearly understood.

6.3.9 Ensure that all equipment is accounted for and decontaminated (refer to ER-SOP-1.08).

7.0 REFERENCES

The following documents have been cited within this procedure.

QP-2.2, Personnel Orientation and Training

QP-4.2, Standard Operating Procedure Development

QP-4.3, Records Management

ER-SOP-1.03, Handling, Packaging, and Shipping of Samples

ER-SOP-1.04, Sample Control and Field Documentation

ER-SOP-1.08, Field Decontamination of Drilling and Sampling Equipment

ER-SOP-4.01, Drilling Methods and Drill Site Management

ER-SOP-5.01, Monitoring Well and RFI Borehole Construction

ER-SOP-7.02, Fluid Level Measurements

EPA, “RCRA Ground Water Monitoring Technical Enforcement Guidance Document,” (OSWER, Washington D.C., 1986) (EPA-530SW86055).

EPA, “Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells,” (Environmental Monitoring Systems Laboratory, Office of Research and Development, 1991).

8.0 RECORDS

The **FTL** is responsible for submitting the following records (processed in accordance with QP-4.3) to the Records Processing Facility.

8.1 Completed Borehole/Well Construction Field Data Log (Attachment B in ER-SOP 5.01)

8.2 Completed Daily Drilling Summary Log (Attachment C in ER-SOP 4.01), which will include calibration data, deviations, and any additional comments.

9.0 ATTACHMENTS

The document user may employ documentation formats different from those attached to/named in this procedure—as long as the substituted formats in use provide, as a minimum, the information required in the official forms developed by the procedure.

Attachment A: Well Development Equipment and Supplies Checklist (1 page)

Attachment B: Surge Block Schematics (1 page)

Well Development Equipment and Supplies Checklist

____ Water level measurement probe
____ Electrical conductivity meter
____ Distilled water
____ Stopwatch
____ Plastic sheet
____ Boiler
____ Pump
____ Surge block
____ Equipment and supplies listed in Attachment A of ER-SOP-4.01
____ Borehole/Well Completion Information form (Attachment A in ER-SOP-5.01)
____ Any PPE listed or required in the SSHASP
____ Any additional supplies listed in associated procedures, as needed
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Other method-specific equipment (add below)

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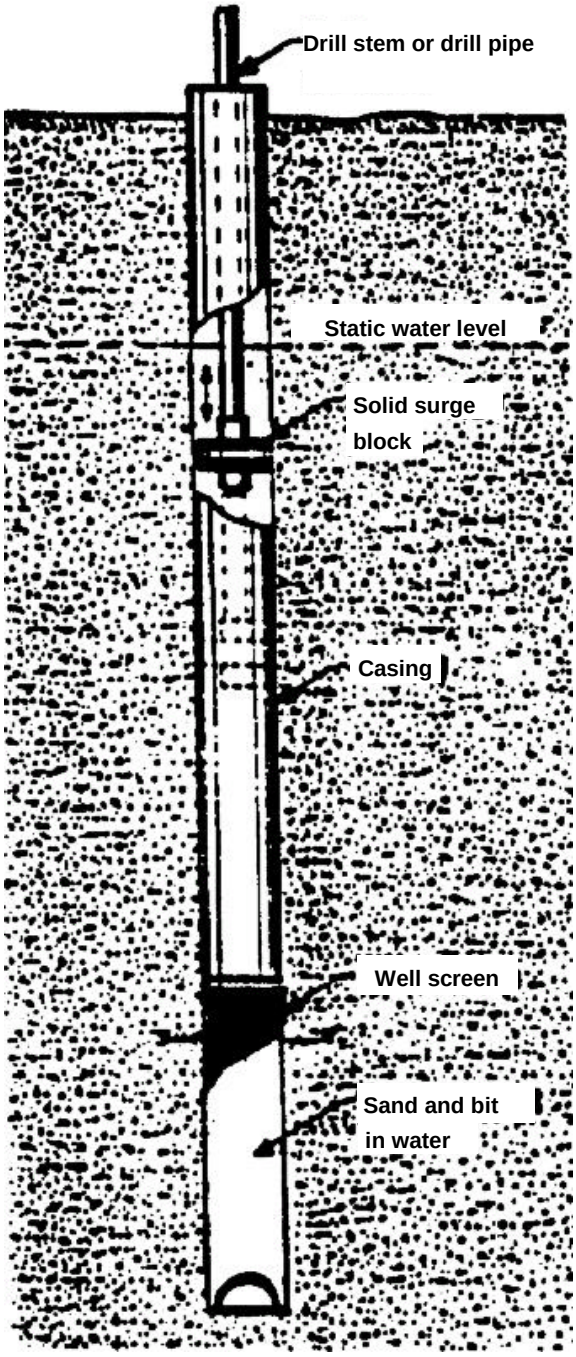
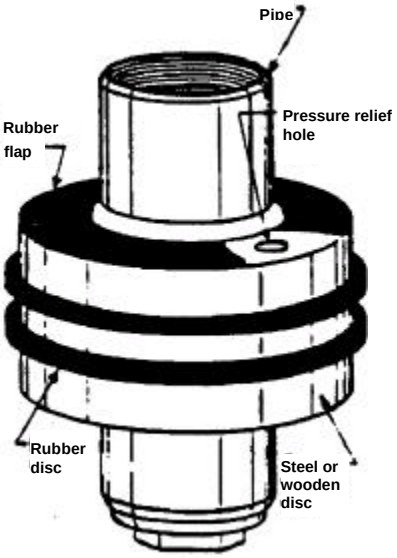
Surge Block Schematics





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